Java Chapter 3: Decisions

Contents

Time required: 90 minutes

DRY

Don't **R**epeat **Y**ourself

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Visualize and Debug Programs

The website www.pythontutor.com helps you create visualizations for the code in all the listings and step through those programs one instruction at a time. As you do that, pay attention to the movements of the red and green arrows on the left, the diagram on the right, and the printed material at the bottom. This will help you to better understand the behavior of the programs we are working on.

This is a great way to debug your code. You can see the variables change as you step through the program.

https://pythontutor.com/java.html#mode=edit

Tutorial 3.1 - IsItPositive

This program uses an **if** statement to determine if we have a positive number.

Create and test the following program called **IsItPositive.java**

```
 1 // Name: IsItPositive.java
 2 // Written by:
 3 // Written on:
 4 // Purpose: Is the number greater than 0
 5
 6 public class IsItPositive {
 7     public static void main(String[] args) {
 8
 9         int number = 10;
10
11         // If number is greater than 0
12         if (number > 0) {
13             System.out.println(number + " is positive.");
14         }
15
16         System.out.println("Statement outside if block");
17     }
18 }
```

Example program run:

```
10 is positive.
Statement outside if block
```

Tutorial 3.2 - IsItPositive2

This program uses an **if else** statement to determine if we have a positive or negative number.

Create and test the following program called **IsItPositive2.java**

```java
 1 // Name: IsItPositive2.java
 2 // Written by:
 3 // Written on:
 4 // Purpose: Is the number positive or negative
 5
 6 // Import Scanner library for input
 7 import java.util.Scanner;
 8
 9 public class IsItPositive2 {
10     public static void main(String[] args) {
11         // Declare Scanner object and initialize with
12         // predefined standard input object, System.in
13         Scanner keyboard = new Scanner(System.in);
14
15         // Declare integer variable for user input
16         int number = 0;
17
18         // Print the heading and prompt
19         System.out.println("+------------------------------------+");
20         System.out.println("|--    Is the Number Positive?    --|");
21         System.out.println("+------------------------------------+");
22         System.out.print("Enter a number: ");
23
24         // Get integer from the keyboard
25         // Assign integer to variable
26         number = keyboard.nextInt();
27
28         // If number is greater than 0
29         if (number > 0) {
30             System.out.println(number + " is positive.");
31         } else {
32             System.out.println(number + " is negative.");
33         }
34         keyboard.close();
35     }
36 }
```

Example run:

```
   ----jGRASP exec: java IsItPositive2
  +---------------------------------+
  |--    Is the Number Positive?    --|
  +---------------------------------+
► Enter a number: 5
  5 is positive.

   ----jGRASP: operation complete.

   ----jGRASP exec: java IsItPositive2
  +---------------------------------+
  |--    Is the Number Positive?    --|
  +---------------------------------+
► Enter a number: -9
  -9 is negative.

   ----jGRASP: operation complete.
```

Tutorial 3.3 - Grades

Here is a simple use of an **if** statement is to assign letter grades. Suppose that scores 90 and above are A's, scores in the 80s are B's, 70s are C's, 60s are D's, and anything below 60 is an F. Here is one way to do this:

```python
1  # Less effecient decision structure
2
3  grade = int(input("Enter your score: "))
4
5  if grade >= 90:
6      print("A")
7  elif grade >= 80 and grade < 90:
8      print("B")
9  elif grade >= 70 and grade < 80:
10     print("C")
11 elif grade >= 60 and grade < 70:
12     print("D")
13 else:
14     print("F")
```

The code above is straightforward, and it works. A more elegant and simpler way to do it is shown below

Create and save the following program as **Grades.java**

```java
 1 // Name: Grades.java
 2 // Written by:
 3 // Written on:
 4 // Purpose: Is the number positive or negative
 5
 6 // Import Scanner library for input
 7 import java.util.Scanner;
 8
 9 public class Grades {
10     public static void main(String[] args) {
11         // Declare Scanner object and initialize with
12         // predefined standard input object, System.in
13         Scanner keyboard = new Scanner(System.in);
14
15         int score;
16         String letterGrade;
17
18         // Prompt the user for input
19         System.out.println("+-----------------------------------+");
20         System.out.println("|--      Please enter a score      --|");
21         System.out.println("+-----------------------------------+");
22         System.out.print("Enter a score: ");
23
24         // Get integer from the keyboard
25         // Assign integer to variable
26         score = keyboard.nextInt();
27
28         // Determine what the letter grade is
29         if (score >= 90) {
30             letterGrade = "A";
31         } else if (score >= 80) {
32             letterGrade = "B";
33         } else if (score >= 70) {
34             letterGrade = "C";
35         } else if (score >= 60) {
36             letterGrade = "D";
37         } else {
38             letterGrade = "F";
39         }
40
41         System.out.println("The score " + score + " is: " + letterGrade);
42         keyboard.close();
43     }
44 }
```

Example run:

```
+----------------------------------+
|--      Please enter a score    --|
+----------------------------------+
Enter a score: 90
The score 90 is: A

  ----jGRASP: operation complete.

  ----jGRASP exec: java Grades
+----------------------------------+
|--      Please enter a score    --|
+----------------------------------+
Enter a score: 59
The score 59 is: F
```

If we use separate **if** statements, each condition is checked regardless of whether it really needs to be. That is, if the score is a 95, the first program will print an A but then continue on and check to see if the score is a B, C, etc., which is a bit of a waste.

Using **else if**, as soon as we find where the score matches, we stop checking conditions and skip all the way to the end of the whole block of statements.

```
elif grade >= 80 and grade < 90:
    print("B")
```

When using **else if**, the second part of the second if statement condition, **grade < 90**, becomes unnecessary because the corresponding **else if** does not have to worry about a score of 90 or above, as such a score would have already been caught by the first if statement.

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Assignment Submission

1. Attach the pseudocode.

2. Attach the program files.

3. Attach screenshots showing the successful operation of the program.

4. Submit in Blackboard.